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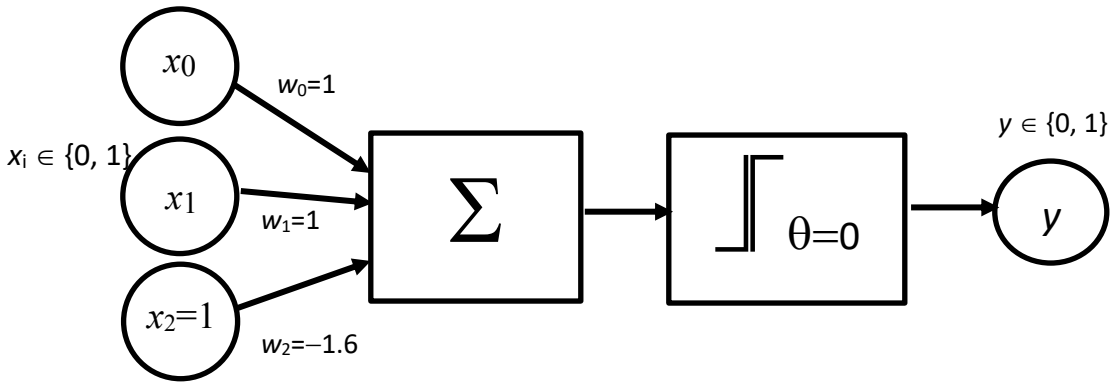
Perceptrons and Perceptron Learning

Perceptron Pete has created a nice module (the PANDa) that he claims can be used ready-to-go as a logical AND unit, or after some training, as something to compute whatever binary logic function you want.



1. Show that the PANDa correctly computes the logical AND function by filling in the following table:

x_0	x_1	x_2	W • X	y
0	0	1	-1.6	0
0	1	1	-0.6	0
1	0	1	-0.6	0
1	1	1	0.4	1

2. Now, Xtreme Xerxes wants a module to compute the following function, and so he proceeds to train the PANDa above by using the training sequence ⟨ *a, b, c, d, a, b, c, d, …* ⟩ with learning rate α = 0.5.

	x_0	x_1	x_2	W • X	y
a	0	0	1	-1.6	0
b	0	1	1	-0.6	1
c	1	0	1	-0.1	1
d	1	1	1	2.4	0

a. Show the weight vector W after the first step of training (after training example *a*).
$W_0=1, W_1=1, W_2=-1.6$

b. Show the weight vector W after the first 2 steps of training (after training examples *a* and *b*).
$W_0=1, W_1=1.5, W_2=-1.1$

c. Show the weight vector W after the first 3 steps of training (after training examples *a, b* and *c*).
$W_0=1.5, W_1=1.5, W_2=-0.6$

d. Show the weight vector W after the first 4 steps of training (after training examples, *a, b, c* and *d*).
$W_0=1, W_1=1, W_2=-1.1$

e. Give an estimate of the number of steps that will be needed to complete the training.
16 steps

UPDATE FORMULA FOR PERCEPTRON TRAINING:
if X is classified incorrectly, do the update
s = {+1 if $W^i \bullet X < 0$; –1 otherwise}
$W^{i+1} = W^i + s\ \alpha\ X$

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